

VOLUME ONE

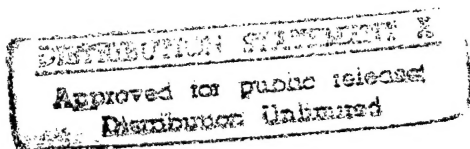
EXECUTIVE SUMMARY

OF

ENERGY ENGINEERING ANALYSIS PROGRAM (EEAP)

PRESIDIO OF SAN FRANCISCO, CALIFORNIA

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FOR

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BY

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SAN FRANCISCO, CALIFORNIA

SEPTEMBER 1986

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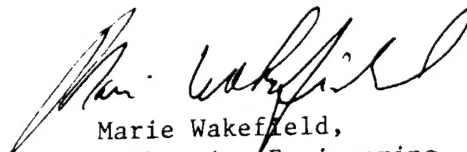


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## TABLE OF CONTENTS

### VOLUME ONE

EXECUTIVE SUMMARY

### VOLUME TWO

EXECUTIVE SUMMARY

#### 1.0 INTRODUCTION

- 1.1 Report Organization
- 1.2 Energy Conservation Directives
- 1.3 Previous Energy Conservation Studies
- 1.4 Objectives of this ESOS

#### 2.0 PROCEDURE

- 2.1 Recommended Projects from EEAP Study
- 2.2 Reevaluation of Previously Identified Projects
- 2.3 Energy Projects Programmed Prior to ESOS
- 2.4 General Observations (Except 1800 Area)
- 2.5 General Observations for 1800 Area

#### 3.0 CONCLUSIONS

- 3.1 Recommended Energy Conservation Opportunities
- 3.2 Low Cost-No Cost Projects
- 3.3 Other Energy Conservation Considerations
- 3.4 Equipment Replacement
- 3.5 Training Courses for Maintenance Personnel
- 3.6 Plan for Implementation
- 3.7 Areas for Further Study

#### APPENDICES

- A. Funded Projects and Low Cost/No Cost Projects -  
Calculations and Cost Estimates
- B. Reevaluation of Previously Identified Projects and  
Infeasible Projects - Calculations, Economic  
Analyses and Cost Estimates
- C. Scope of Work
- D. Minutes of Pre-negotiation Meeting
- E. Field Notes
- F. Cogeneration Letter, FMCA 246

## TABLE OF CONTENTS

### VOLUME THREE

#### PROJECT DOCUMENTATION

| <u>PROJECT NUMBER</u> | <u>TITLE</u>   |
|-----------------------|--|
| QRIP-1                | Insulate Water Heaters - Family Housing  |
| QRIP-2                | Caulk Foundation Joints - Family Housing   |
| ECIP-FHA-1            | Weatherstrip Windows - Family Housing  |
| OSD PIF-1             | Vent Dampers for Heating Boilers - Family Housing  |
| PECIP-1               | Insulate Water Heaters   |
| OSD PIF-2             | Consolidate Loads - Marina Gate Substation,<br>Fort Scott Substation, Building 70 Substation |
| ECIP-FHA-2            | Vent Dampers for Water Heaters and Insulate Domestic<br>Hot Water Piping - Family Housing    |
| ECIP-1                | Replace Heating Boilers  |
| OSD PIF-3             | Insulate Ductwork - Family Housing   |
| ECIP-FHA-3            | Insulate Walls - Family Housing  |
| ECIP-FHA-4            | Replace Heating Boilers-Family Housing   |
| LC-1                  | Secure Steam Line to Building 1818   |
| LC-2                  | Secure Hot Water Tank - Building 1802  |
| LC-3                  | Secure Hot Water Storage Tanks - Building 1801   |
| LC-4                  | Secure Hot Water Tank - Building 1807  |
| LC-5                  | Improve Power Factor - Marina Gate Substation  |
| LC-6                  | Vent Dampers for Water Heaters   |
| LC-7                  | Insulate Domestic Hot Water Piping   |
| LC-8                  | Insulate Ductwork  |
| LC-9                  | Replace Incandescent Lighting with High Pressure Sodium                                      |
| LC-10                 | Waste-Oil-Fired Boiler-Building 135  |

## PURPOSE

This Energy Savings Opportunity Survey (ESOS) study was initiated to supplement prior energy conservation efforts at the Presidio of San Francisco. While previous recommendations concentrated on projects requiring substantial funds for implementation, the thrust of the ESOS is to generate energy projects for all types of funding.

## SCOPE OF WORK OUTLINE

- o Review for general information the previously completed Energy Engineering Analysis Program (EEAP) study and any other energy studies which were performed at this installation.
- o Reevaluate selected projects and Energy Conservation Opportunities (ECOs) from the previous studies to determine their economic feasibility based on revised criteria, current site conditions and technical applicability.
- o Evaluate selected ECOs to determine their energy savings potential and economic feasibility.
- o Perform a limited site survey of selected buildings or areas to insure that any new methods of energy conservation which are practical and have not been evaluated in any previous energy study have been considered and the results documented.
- o Summarize and prioritize all energy conservation opportunities and projects from this study and all previous studies for use by the Installation Commander and Director of Engineering and Housing in developing their energy management plans.
- o Provide complete new programming or implementation documentation for all recommended ECOs.
- o Provide recommendations for training of Directorate of Engineering and Housing (DEH) personnel and for replacement of expendable equipment.
- o Prepare a comprehensive report to document the work performed, the results and the recommendations.

## REEVALUATION OF PREVIOUSLY IDENTIFIED PROJECTS

A group of nine projects, which were identified as potential energy saving measures but were never implemented, were evaluated in this study. Five of these projects were previously evaluated in the 1979 EEAP.

Of the nine projects, six were found to be currently infeasible. Pertinent economic data for these projects is presented in Table A. The other three ECOs, Wall Insulation for Family Housing, Waste-Oil-Fired Boiler, and Replace Existing Heating Boilers, are feasible. Due to funding regulations, the ECO to Replace Existing Heating Boilers was divided into two projects. Economic data for these feasible projects is summarized in Tables B and C.

Table A

## Reevaluation of Previously Identified Projects

| Project Title                     | Energy<br>MBtu | Savings<br>\$ | Non-Energy<br>Savings (\$)<br>(Cost) | Total Annual<br>Savings (\$)<br>(Cost) | Construction<br>Cost (\$) | SIR    | Simple<br>Payback Period<br>(Yrs) |
|-----------------------------------|----------------|---------------|--------------------------------------|--|---------------------------|--------|-----------------------------------|
| High-Efficiency Motor Replacement | 138            | 713           | -                                    | 713                                    | 11,800                    | 0.89   | 16.6                              |
| Storm Windows (Per Window)        | 0.5            | 3             | -                                    | 3                                      | 225                       | 0.26   | 75.3                              |
| Solar Domestic Hot Water          | 18.5           | 111           | -                                    | 111                                    | 8,330                     | 0.26   | 75.3                              |
| Wind Power Electrical Generation  | 3,005          | 15,536        | (52,000)                             | (36,464)                               | 1,100,000                 | (0.34) | -                                 |
| Solar Space Heating               | 128.4          | 770           | (350)                                | 420                                    | 35,500                    | 0.31   | 84.8                              |
| Replace Existing Water Heaters    | 7,069          | 42,414        | (12,000)                             | 30,414                                 | 1,200,000                 | 0.57   | 39.6                              |

## RECOMMENDED PROJECTS

A site survey was conducted, in selected buildings (Annex B of the Scope of Work), to provide data on which to base our recommendations. Potential energy conservation opportunities (ECOs), found in Annex A of the Scope of Work, were evaluated for the buildings surveyed. While some strides have been made towards achieving the conservation goals of the base, we found further ECOs that are economically feasible. These include savings in such systems as heating, domestic hot water, lighting, electrical distribution, and operations and maintenance.

Following the directions of the scope of work, a few buildings in each group of "typical buildings" were surveyed, and the data thus gathered was extrapolated to include all buildings in that group. Although the ECOs presented in this report are feasible regardless of the magnitude of construction involved, if we underestimate the scope for a project, adequate funds may not be available to complete construction and, alternately, if we overestimate the scope we may be overestimating the potential energy savings. Every effort was made to be conservative with energy savings without underestimating costs. ECOs were then placed into various funding programs following the recommendations of personnel from the Presidio of San Francisco, FORSCOM, and the Sacramento District Corps of Engineers.

For the projects requiring \$3,556,950 in MILCON funds for implementation, yearly savings of 70,625 MBtu of natural gas and 16,342 MBtu of electricity, with annual cost savings amounting to \$506,072 may be realized. A summary of the savings from each of these ECOs is presented in Table B.

Low Cost/No Cost projects that are within the funding jurisdiction of the installation can produce annual savings of 3,275 MBtu of natural gas and 3,876 MBtu of electricity or annual cost savings of \$29,809. These projects are summarized in Table C.

## EQUIPMENT REPLACEMENT

Guidelines for replacement of debilitated equipment with higher efficiency models has been included.

Pulse ignition fired water heating boilers and forced air furnaces can achieve energy savings by operating more efficiently than conventional heating equipment can. While these products have limited availability at the present time, we recommend their use when applicable.

Electric motors should be replaced with high efficiency models suited for the intended duty. High efficiency motors are readily available from a number of manufacturers.

Lighting is another area where the use of high efficiency replacement equipment is recommended. The application of fluorescent lamps which fit standard incandescent sockets is recommended as an energy saving measure.



Table B

# Summary of Energy Conservation Opportunities

## Funded Projects

| Project Number | Project Title  | Annual Energy Savings<br>Natural Gas (MBtu) | Elec-<br>tricity (MBtu) | Total Savings (MBtu) | Annual Savings (\$) | Construc-<br>tion Cost (\$) | Savings Investment Ratio | Simple Pay-<br>Back (Years) | Cost Breakdown<br>Material (\$) | Labor (Hours) |
|----------------|--|---|-------------------------|----------------------|---------------------|-----------------------------|--------------------------|-----------------------------|---------------------------------|---------------|
| QRIP-1         | Insulate Water Heaters - Family Housing  | 816   | -                       | 816                  | 4,896               | 8,650                       | 5.37                     | 1.8                         | 1,345                           | 175           |
| QRIP-2         | Caulk Foundation Joints - Family Housing   | 663   | -                       | 663                  | 3,978               | 7,800                       | 4.84                     | 2.0                         | 1,680                           | 145           |
| ECIP-FHA-1     | Weatherstrip Windows-Family Housing  | 14,655                                      | -                       | 14,655               | 87,930              | 484,500                     | 3.52                     | 5.5                         | 72,310                          | 9,790         |
| OSD PIF-1      | Vent Dampers for Heating Boilers-Family Housing  | 7,317                                       | -                       | 7,317                | 43,260              | 126,100                     | 3.30                     | 2.9                         | 42,300                          | 1,995         |
| PECIP-1        | Insulate Water Heaters   | 217   | -                       | 217                  | 1,302               | 4,300                       | 3.14                     | 3.3                         | 665                             | 90            |
| OSD PIF-2      | Consolidate Loads - Marina Gate Substation, Fort Scott Substation, Building 70 Substation          | -   | 16,342                  | 16,342               | 84,488              | 306,000                     | 2.62                     | 3.6                         | 162,375                         | 3,420         |
| ECIP-FHA-2     | Vent Dampers for Water Heaters-Family Housing and Insulate Domestic Hot Water Pipes-Family Housing | 6,315                                       | -                       | 6,315                | 36,366              | 282,600                     | 2.54                     | 7.8                         | 80,315                          | 4,355         |
| ECIP-1         | Replace Heating Boilers  | 6,527                                       | -                       | 6,527                | 39,162              | 310,000                     | 2.45                     | 7.9                         | 206,560                         | 2,470         |
| OSD PIF-3      | Insulate Ductwork-Family Housing   | 4,551                                       | -                       | 4,551                | 27,306              | 107,000                     | 2.42                     | 3.9                         | 10,475                          | 2,300         |
| ECIP-FHA-3     | Insulate Walls - Family Housing  | 21,608                                      | -                       | 21,608               | 129,648             | 1,110,000                   | 2.27                     | 8.6                         | 214,480                         | 21,350        |
| ECIP-FHA-4     | Replace Heating Boilers Family Housing   | 7,956                                       | -                       | 7,956                | 47,736              | 810,000                     | 1.14                     | 17.0                        | 470,000                         | 8,120         |
| TOTALS         |  | 70,625                                      | 16,342                  | 86,967               | 506,072             | 3,556,950                   |                          |                             | 1,262,505                       | 54,210        |

Table C

# Summary of Energy Conservation Opportunities

## Low Cost - No Cost Projects

| Project Number | Project Title   | Annual Energy Savings |                    | Total Savings (MBtu) | Annual Savings (\$) | Construction Cost (\$) | Savings Investment Ratio | Simple Pay-Back (Years) | Cost Breakdown |               |
|----------------|---|-----------------------|--------------------|----------------------|---------------------|------------------------|--------------------------|-------------------------|----------------|---------------|
|                |   | Natural Gas (MBtu)    | Electricity (MBtu) |                      |                     |                        |                          |                         | Material (\$)  | Labor (Hours) |
| LC-1           | Secure Steam Line to Building 1818                      | 131                   | --                 | 131                  | 786                 | 25                     | 610.63                   | <1.0                    | --             | 1             |
| LC-2           | Secure Hot Water Tank - Building 1802                   | 179                   | --                 | 179                  | 1,074               | 100                    | 208.59                   | <1.0                    | 50             | 2             |
| LC-3           | Secure Hot Water Tanks - Building 1801                  | 177                   | --                 | 177                  | 1,062               | 270                    | 76.39                    | <1.0                    | 120            | 6             |
| LC-4           | Secure Hot Water Tank - Building 1807                   | 33                    | --                 | 33                   | 198                 | 60                     | 64.09                    | <1.0                    | 10             | 2             |
| LC-5           | Improve Power Factor - Marina Gate Substation           | --                    | 3,824              | 3,824                | 19,770              | 93,500                 | 3.12                     | 4.7                     | 77,915         | 510           |
| LC-6           | Vent Dampers for Water Heaters                          | 285                   | --                 | 285                  | 1,446               | 14,000                 | 2.17                     | 9.7                     | 4,185          | 235           |
| LC-7           | Insulate Domestic Hot Water Piping                      | 331                   | --                 | 331                  | 1,986               | 21,200                 | 1.82                     | 10.7                    | 8,015          | 315           |
| LC-8           | Insulate Ductwork                                       | 205                   | --                 | 205                  | 1,230               | 14,600                 | 1.63                     | 11.9                    | 1,430          | 320           |
| LC-9           | Replace Incandescent Lighting With High Pressure Sodium | --                    | 52                 | 52                   | 393                 | 3,600                  | 1.50                     | 9.2                     | 2,405          | 25            |
| LC-10          | Waste Oil Boiler  | 1,934                 | --                 | 1,934                | 1,864               | 96,000                 | 1.18                     | 51.7                    | 73,640         | 530           |
| TOTALS         |   | 3,275                 | 3,876              | 7,151                | 29,809              | 243,355                |                          |                         | 167,770        | 1,946         |

## PERSONNEL TRAINING

Military and commercial training courses for maintenance personnel were researched for applicability. A number of courses were found that could provide the maintenance group with a basis for personnel training. Subjects covered by these courses include: refrigeration and air conditioning systems, energy conservation, preventive maintenance, control systems, water treatment, boiler maintenance, pump maintenance, and operation and maintenance of electric motors. Implementation of a training program is recommended.

## IMPLEMENTATION

Implementation of all the recommended projects will save a significant amount of energy. The effect of these savings is illustrated graphically in Exhibits A and B which follow.

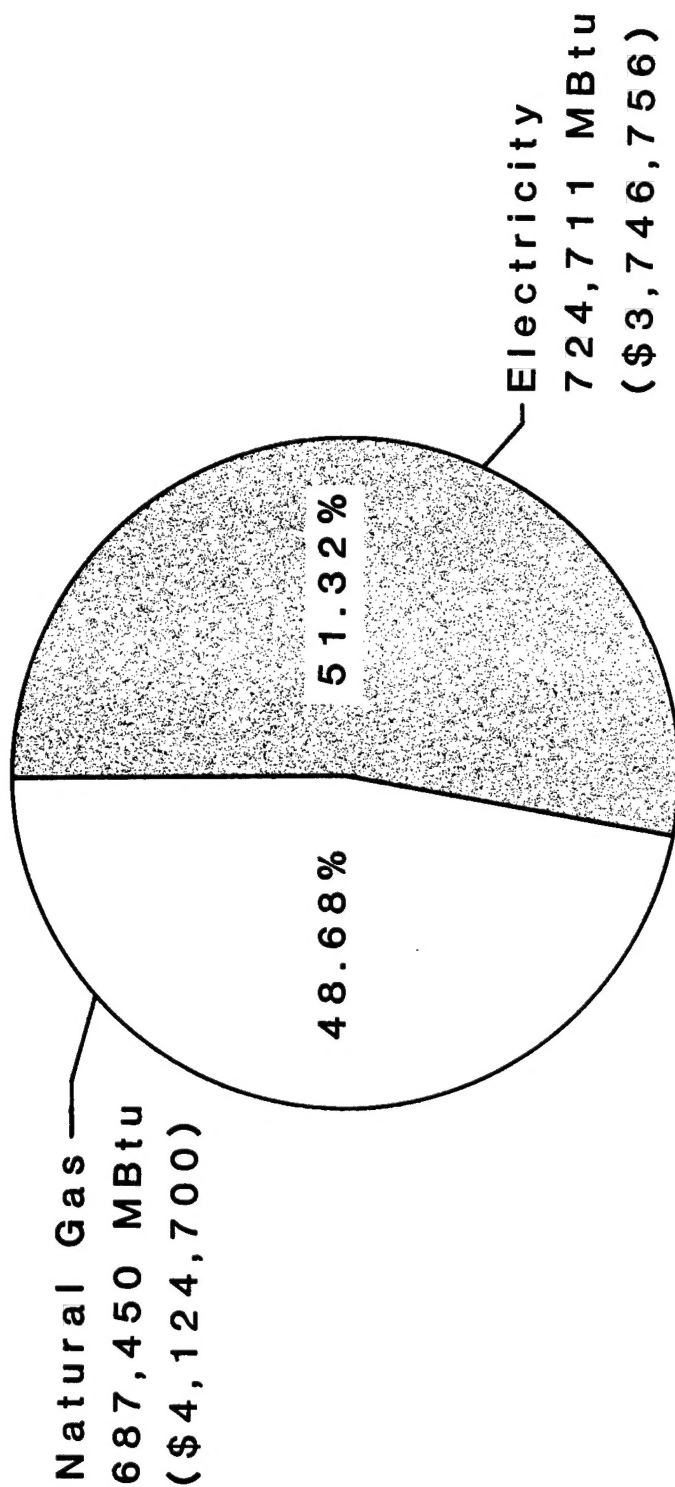


Exhibit A

Fiscal Year 1985 Energy Consumption



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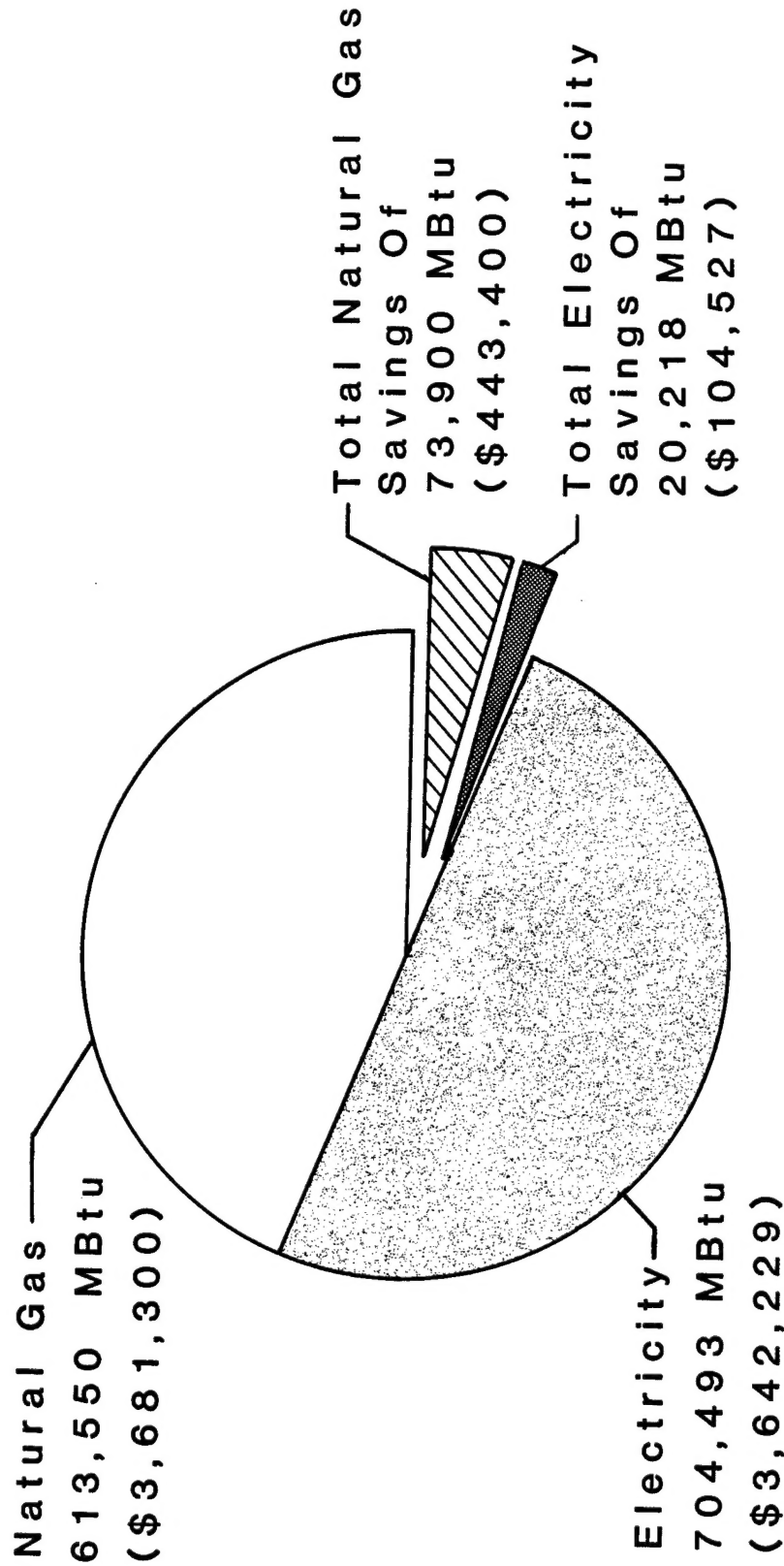


Exhibit B

**Projected Annual Energy Consumption  
With Funded And Low Cost - No Cost Programs Completed**



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